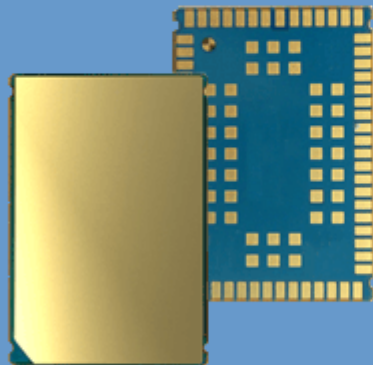




**CINTERION**  
a Gemalto company

## AGS2-W

Version: 01.000  
DocId: AGS2-W\_HIO\_v01.000



# Hardware Interface Overview

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# 1 Introduction

This document<sup>1</sup> describes the hardware of the Cinterion AGS2-W module that connects to the cellular device application and the air interface. It helps you quickly retrieve interface specifications, electrical and mechanical details and information on the requirements to be considered for integrating further components.

## 1.1 Related Documents

- [1] AGS2-W AT Command Set
- [2] AGS2-W Release Note
- [3] AGS2-W MPE calculation - Test report (Maximum Permissible Exposure)

## 1.2 Terms and Abbreviations

Abbreviation	Description
ADC	Analog-to-digital converter
AGC	Automatic Gain Control
ANSI	American National Standards Institute
ARFCN	Absolute Radio Frequency Channel Number
ARP	Antenna Reference Point
ASC0/ASC1	Asynchronous Controller. Abbreviations used for first and second serial interface of AGS2-W
B	Thermistor Constant
BER	Bit Error Rate
BTS	Base Transceiver Station
CB or CBM	Cell Broadcast Message
CE	Conformité Européene (European Conformity)
CHAP	Challenge Handshake Authentication Protocol
CPU	Central Processing Unit
CS	Coding Scheme
CSD	Circuit Switched Data
CTS	Clear to Send
DAC	Digital-to-Analog Converter
DAI	Digital Audio Interface
dBm0	Digital level, 3.14dBm0 corresponds to full scale, see ITU G.711, A-law
DCE	Data Communication Equipment (typically modems, e.g. Cinterion GSM module)

1. The document is effective only if listed in the appropriate Release Notes as part of the technical documentation delivered with your Cinterion product.

Abbreviation	Description
DCS 1800	Digital Cellular System, also referred to as PCN
DRX	Discontinuous Reception
DSB	Development Support Box
DSP	Digital Signal Processor
DSR	Data Set Ready
DTE	Data Terminal Equipment (typically computer, terminal, printer or, for example, GSM application)
DTR	Data Terminal Ready
DTX	Discontinuous Transmission
EFR	Enhanced Full Rate
EGSM	Enhanced GSM
EIRP	Equivalent Isotropic Radiated Power
EMC	Electromagnetic Compatibility
ERP	Effective Radiated Power
ESD	Electrostatic Discharge
ETS	European Telecommunication Standard
FCC	Federal Communications Commission (U.S.)
FDMA	Frequency Division Multiple Access
FR	Full Rate
GASDL	Global Automotive Declarable Substance List
GMSK	Gaussian Minimum Shift Keying
GPIO	General Purpose Input/Output
GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications
HiZ	High Impedance
HR	Half Rate
I/O	Input/Output
IC	Integrated Circuit
IMDS	International Material Data System
IMEI	International Mobile Equipment Identity
ISO	International Standards Organization
ITU	International Telecommunications Union
kbps	kbits per second
LED	Light Emitting Diode
Li-Ion/Li+	Lithium-Ion
Li battery	Rechargeable Lithium Ion or Lithium Polymer battery
Mbps	Mbits per second
MMI	Man Machine Interface

Abbreviation	Description
MO	Mobile Originated
MS	Mobile Station (GSM module), also referred to as TE
MSISDN	Mobile Station International ISDN number
MT	Mobile Terminated
NTC	Negative Temperature Coefficient
OEM	Original Equipment Manufacturer
PA	Power Amplifier
PAP	Password Authentication Protocol
PBCCH	Packet Switched Broadcast Control Channel
PCB	Printed Circuit Board
PCL	Power Control Level
PCM	Pulse Code Modulation
PCN	Personal Communications Network, also referred to as DCS 1800
PCS	Personal Communication System, also referred to as GSM 1900
PDU	Protocol Data Unit
PPM	Parts per million
PLL	Phase Locked Loop
PPP	Point-to-point protocol
PSK	Phase Shift Keying
PSU	Power Supply Unit
PWM	Pulse Width Modulation
R&TTE	Radio and Telecommunication Terminal Equipment
RAM	Random Access Memory
RF	Radio Frequency
RLS	Radio Link Stability
RMS	Root Mean Square (value)
RoHS	Restriction of the use of certain hazardous substances in electrical and electronic equipment.
ROM	Read-only Memory
RTC	Real Time Clock
RTS	Request to Send
Rx	Receive Direction
SAR	Specific Absorption Rate
SAW	Surface Accoustic Wave
SELV	Safety Extra Low Voltage
SIM	Subscriber Identification Module
SMD	Surface Mount Device
SMS	Short Message Service



<b>Abbreviation</b>	<b>Description</b>
SMT	Surface Mount Technology
SRAM	Static Random Access Memory
TA	Terminal adapter (e.g. GSM module)
TDMA	Time Division Multiple Access
TE	Terminal Equipment, also referred to as DTE
TLS	Transport Layer Security
Tx	Transmit Direction
UART	Universal asynchronous receiver-transmitter
URC	Unsolicited Result Code
USSD	Unstructured Supplementary Service Data
VSWR	Voltage Standing Wave Ratio


## 1.3 Regulatory and Type Approval Information

### 1.3.1 Directives and Standards


AGS2-W is designed to comply with the directives and standards listed below.

It is the responsibility of the application manufacturer to ensure compliance of the final product with all provisions of the applicable directives and standards as well as with the technical specifications provided in the "AGS2-W Hardware Interface Description".<sup>1</sup>

**Table 1:** Directives

1999/05/EC	Directive of the European Parliament and of the council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (in short referred to as R&TTE Directive 1999/5/EC). The product is labeled with the CE conformity mark <b>CE 0682</b>
ECE-R 10	Economic Commission for Europe (ECE) Regulation No. 10: Uniform provisions concerning the approval of vehicles with regard to electromagnetic compatibility
2002/95/EC	Directive of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) 

**Table 2:** Standards of North American type approval

CFR Title 47	Code of Federal Regulations, Part 22 and Part 24 (Telecommunications, PCS); US Equipment Authorization FCC
UL 60 950-1	Product Safety Certification (Safety requirements) 
NAPRD.03 V5.11	Overview of PCS Type certification review board Mobile Equipment Type Certification and IMEI control PCS Type Certification Review board (PTCRB)
RSS132 (Issue2) RSS133 (Issue5)	Canadian Standard

**Table 3:** Standards of European type approval

3GPP TS 51.010-1	Digital cellular telecommunications system (Phase 2); Mobile Station (MS) conformance specification
ETSI EN 301 511 V9.0.2	Candidate Harmonized European Standard (Telecommunications series) Global System for Mobile communications (GSM); Harmonized standard for mobile stations in the GSM 900 and DCS 1800 bands covering essential requirements under article 3.2 of the R&TTE directive (1999/5/EC) (GSM 13.11 version 7.0.1 Release 1998)
GCF-CC V3.45	Global Certification Forum - Certification Criteria

1. Manufacturers of applications which can be used in the US shall ensure that their applications have a PTCRB approval. For this purpose they can refer to the PTCRB approval of the respective module.


**Table 3:** Standards of European type approval

ETSI EN 301 489-1 V1.8.1	Candidate Harmonized European Standard (Telecommunications series) Electro Magnetic Compatibility and Radio spectrum Matters (ERM); Electro Magnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common Technical Requirements
ETSI EN 301 489-7 V1.3.1	Candidate Harmonized European Standard (Telecommunications series) Electro Magnetic Compatibility and Radio spectrum Matters (ERM); Electro Magnetic Compatibility (EMC) standard for radio equipment and services; Part 7: Specific conditions for mobile and portable radio and ancillary equipment of digital cellular radio telecommunications systems (GSM and DCS)
EN 60950-1:2006/ A11:2009	Safety of information technology equipment

**Table 4:** Requirements of quality

IEC 60068	Environmental testing
DIN EN 60529	IP codes
VDA Hands-free	VDA Specification for Car Hands-free Terminals, Draft, December 2004, v1.5, double talk performance category 2a

**Table 5:** Standards of the Ministry of Information Industry of the People's Republic of China

SJ/T 11363-2006	"Requirements for Concentration Limits for Certain Hazardous Substances in Electronic Information Products" (2006-06).
SJ/T 11364-2006	<p>"Marking for Control of Pollution Caused by Electronic Information Products" (2006-06).</p> <p>According to the "Chinese Administration on the Control of Pollution caused by Electronic Information Products" (ACPEIP) the EPUP, i.e., Environmental Protection Use Period, of this product is 20 years as per the symbol shown here, unless otherwise marked. The EPUP is valid only as long as the product is operated within the operating limits described in the Cinterion Wireless Modules Hardware Interface Description.</p> <p>Please see <a href="#">Table 6</a> for an overview of toxic or hazardous substances or elements that might be contained in product parts in concentrations above the limits defined by SJ/T 11363-2006.</p> 

**Table 6:** Toxic or hazardous substances or elements with defined concentration limits

部件名称 Name of the part	有毒有害物质或元素 Hazardous substances					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
金属部件 (Metal Parts)	○	○	○	○	○	○
电路模块 (Circuit Modules)	X	○	○	○	○	○
电缆及电缆组件 (Cables and Cable Assemblies)	○	○	○	○	○	○
塑料和聚合物部件 (Plastic and Polymeric parts)	○	○	○	○	○	○

O:  
表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006 标准规定的限量要求以下。  
Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006.

X:  
表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006标准规定的限量要求。  
Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part *might exceed* the limit requirement in SJ/T11363-2006.

#### 1.3.2 SAR requirements specific to portable mobiles

Mobile phones, PDAs or other portable transmitters and receivers incorporating a GSM module must be in accordance with the guidelines for human exposure to radio frequency energy. This requires the Specific Absorption Rate (SAR) of portable AGS2-W based applications to be evaluated and approved for compliance with national and/or international regulations.

Since the SAR value varies significantly with the individual product design manufacturers are advised to submit their product for approval if designed for portable use. For European and US-markets the relevant directives are mentioned below. It is the responsibility of the manufacturer of the final product to verify whether or not further standards, recommendations or directives are in force outside these areas.

##### *Products intended for sale on US markets*

ES 59005/ANSI C95.1 Considerations for evaluation of human exposure to Electromagnetic Fields (EMFs) from Mobile Telecommunication Equipment (MTE) in the frequency range 30MHz - 6GHz

##### *Products intended for sale on European markets*







EN 50360 Product standard to demonstrate the compliance of mobile phones with the basic restrictions related to human exposure to electromagnetic fields (300MHz - 3GHz)

##### **IMPORTANT:**

Manufacturers of portable applications based on AGS2-W modules are required to have their final product certified and apply for their own FCC Grant and Industry Canada Certificate related to the specific portable mobile (see also [Section 7.2](#)).

### 1.3.3 Safety Precautions

The following safety precautions must be observed during all phases of the operation, usage, service or repair of any cellular terminal or mobile incorporating AGS2-W. Manufacturers of the cellular terminal are advised to convey the following safety information to users and operating personnel and to incorporate these guidelines into all manuals supplied with the product. Failure to comply with these precautions violates safety standards of design, manufacture and intended use of the product. Cinterion Wireless Modules assumes no liability for customer's failure to comply with these precautions.

	<p>When in a hospital or other health care facility, observe the restrictions on the use of mobiles. Switch the cellular terminal or mobile off, if instructed to do so by the guidelines posted in sensitive areas. Medical equipment may be sensitive to RF energy. The operation of cardiac pacemakers, other implanted medical equipment and hearing aids can be affected by interference from cellular terminals or mobiles placed close to the device. If in doubt about potential danger, contact the physician or the manufacturer of the device to verify that the equipment is properly shielded. Pacemaker patients are advised to keep their hand-held mobile away from the pacemaker, while it is on.</p>
	<p>Switch off the cellular terminal or mobile before boarding an aircraft. Make sure it cannot be switched on inadvertently. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communications systems. Failure to observe these instructions may lead to the suspension or denial of cellular services to the offender, legal action, or both.</p>
	<p>Do not operate the cellular terminal or mobile in the presence of flammable gases or fumes. Switch off the cellular terminal when you are near petrol stations, fuel depots, chemical plants or where blasting operations are in progress. Operation of any electrical equipment in potentially explosive atmospheres can constitute a safety hazard.</p>
	<p>Your cellular terminal or mobile receives and transmits radio frequency energy while switched on. Remember that interference can occur if it is used close to TV sets, radios, computers or inadequately shielded equipment. Follow any special regulations and always switch off the cellular terminal or mobile wherever forbidden, or when you suspect that it may cause interference or danger.</p>
	<p>Road safety comes first! Do not use a hand-held cellular terminal or mobile when driving a vehicle, unless it is securely mounted in a holder for speakerphone operation. Before making a call with a hand-held terminal or mobile, park the vehicle. Speakerphones must be installed by qualified personnel. Faulty installation or operation can constitute a safety hazard.</p>
	<p><b>IMPORTANT!</b> Cellular terminals or mobiles operate using radio signals and cellular networks. Because of this, connection cannot be guaranteed at all times under all conditions. Therefore, you should never rely solely upon any wireless device for essential communications, for example emergency calls. Remember, in order to make or receive calls, the cellular terminal or mobile must be switched on and in a service area with adequate cellular signal strength. Some networks do not allow for emergency calls if certain network services or phone features are in use (e.g. lock functions, fixed dialing etc.). You may need to deactivate those features before you can make an emergency call. Some networks require that a valid SIM card be properly inserted in the cellular terminal or mobile.</p>

## 2 Product Concept

### 2.1 Key Features at a Glance

Feature	Implementation
<i>General</i>	
Frequency bands	Quad band: GSM 850/900/1800/1900MHz
GSM class	Small MS
Output power (according to Release 99, V5)	Class 4 (+33dBm $\pm$ 2dB) for EGSM850 Class 4 (+33dBm $\pm$ 2dB) for EGSM900 Class 1 (+30dBm $\pm$ 2dB) for GSM1800 Class 1 (+30dBm $\pm$ 2dB) for GSM1900
Power supply	3.3V to 4.5V
Operating temperature (board temperature)	Normal operation: -30°C to +85°C Extended operation: -40°C to -30°C, +85°C to +90°C
Physical	Dimensions: 27.6mm x 18.8mm x 2.7mm Weight: approx. 3 g
RoHS	All hardware components fully compliant with EU RoHS Directive
<i>GSM/GPRS features</i>	
Data transfer	GPRS: <ul style="list-style-type: none"> <li>• Multislot Class10</li> <li>• Full PBCCH support</li> <li>• Mobile Station Class B</li> <li>• Coding Scheme 1 – 4</li> </ul> CSD: <ul style="list-style-type: none"> <li>• V.110, RLP, non-transparent</li> <li>• 2.4, 4.8, 9.6, 14.4kbps</li> <li>• USSD</li> </ul> PPP-stack for GPRS data transfer
SMS	Point-to-point MT and MO Cell broadcast Text and PDU mode Storage: SIM card plus 25 SMS locations in mobile equipment Transmission of SMS alternatively over CSD or GPRS. Preferred mode can be user defined. Transmission of SMS over GSM.
Fax	Group 3; Class 1

Feature	Implementation
Audio	Speech codecs: <ul style="list-style-type: none"> <li>• Half rate HR (ETS 06.20)</li> <li>• Full rate FR (ETS 06.10)</li> <li>• Enhanced full rate EFR (ETS 06.50/06.60/06.80)</li> <li>• Adaptive Multi Rate AMR</li> </ul> Handsfree operation (VDA), echo cancellation, noise suppression, 7 different ringing tones/melodies
<i>Software</i>	
AT commands	Hayes 3GPP TS 27.007, TS 27.005, Cinterion AT commands for RIL compatibility
Microsoft™ compatibility	RIL for Pocket PC and Smartphone
SIM Application Toolkit	SAT Release 99
TCP/IP stack	Access by AT commands
Firmware update	Generic update from host application over ASC0 or ASC1.
<i>Interfaces</i>	
Module interface	Surface mount device with solderable connection pads (SMT application interface).  Land grid array (LGA) technology ensures high solder joint reliability and provides the possibility to use an optional module mounting socket.
2 serial interfaces	ASC0: <ul style="list-style-type: none"> <li>• 8-wire modem interface with status and control lines, unbalanced, asynchronous</li> <li>• Adjustable baud rates: 1,200bps to 230,400bps</li> <li>• Autobauding: 1,200bps to 230,400bps</li> <li>• Supports RTS0/CTS0 hardware handshake and software XON/XOFF flow control.</li> <li>• Multiplex ability according to GSM 07.10 Multiplexer Protocol.</li> </ul> ASC1: <ul style="list-style-type: none"> <li>• 4-wire, unbalanced asynchronous interface</li> <li>• Adjustable baud rates: 1,200bps to 230,400bps</li> <li>• Supports RTS1/CTS1 hardware handshake and software XON/XOFF flow control</li> </ul>
Audio	1 analog interface (with microphone feeding) 1 digital interface (PCM)
UICC interface	Supported SIM/USIM cards: 3V, 1.8V External SIM card reader has to be connected via interface connector (note that card reader is not part of AGS2-W)
GPIO interface	GPIO interface with 6 GPIO lines. The GPIO interface is shared with an I2C interface, LED signalling and PWM functionality or antenna detection.
Antenna	50Ω



Feature	Implementation
<i>Power on/off, Reset</i>	
Power on/off	Switch-on by hardware signal ON Switch-off by AT command (AT^SMSO) Automatic switch-off in case of critical temperature and voltage conditions.
Reset	Orderly shutdown and reset by AT command
<i>Special features</i>	
Real time clock	Timer functions via AT commands
Phonebook	SIM and phone
TTY/CTM support	Integrated CTM modem
TLS security	Transport layer security
eCall	EU
RLS monitoring	Jamming detection
Miscellaneous	Prepared for under-fill Automotive grade service levels Automotive test specification X-ray inspection IMDS compliant GASDL listed No repair E-marking

## 2.2 Automotive Feature Overview

- Automotive grade mounting
- Voice as per VDA 6.2 / TS16949
- Deferred shut down
- Antenna diagnostics
- EU eCall prepared
- Remote SIM access profile
- Advanced temperature management
- Automotive PPM level

---

## 3 Application Interface

AGS2-W is equipped with an SMT application interface that connects to the external application. The host interface incorporates several sub-interfaces: power supply, SIM interface, serial interface ASC0, serial interface ASC1, analog audio interface, GPIO interface, I<sup>2</sup>C interface and PWM interface (for details see [Chapter 2](#) and [Section 5.6](#)). described in the following sections:

### 3.1 Operating Modes

The table below briefly summarizes the various operating modes referred to in the following chapters.

**Table 7:** Overview of operating modes

Normal operation	GSM/GPRS SLEEP	<p>Various power save modes set with AT+CFUN command.</p> <p>Software is active to minimum extent. If the module was registered to the GSM network in IDLE mode, it is registered and paging with the BTS in SLEEP mode, too. Power saving can be chosen at different levels: The NON-CYCLIC SLEEP mode (AT+CFUN=0) disables the AT interface. The CYCLIC SLEEP modes AT+CFUN=7 and 9 alternately activate and deactivate the AT interfaces to allow permanent access to all AT commands.</p>
	GSM IDLE	<p>Software is active. Once registered to the GSM network, paging with BTS is carried out. The module is ready to send and receive.</p>
	GSM TALK	<p>Connection between two subscribers is in progress. Power consumption depends on network coverage individual settings, such as DTX off/on, FR/EFR/HR, hopping sequences, antenna.</p>
	GPRS IDLE	<p>Module is ready for GPRS data transfer, but no data is currently sent or received. Power consumption depends on network settings and GPRS configuration (e.g. multislot settings).</p>
	GPRS DATA	<p>GPRS data transfer in progress. Power consumption depends on network settings (e.g. power control level), uplink/downlink data rates, GPRS configuration (e.g. used multislot settings) and reduction of maximum output power.</p>
Power Down	<p>Normal shutdown after sending the AT^SMSO command. Only a voltage regulator is active for powering the RTC. Software is not active. Interfaces are not accessible. Operating voltage (connected to BATT+) remains applied.</p>	
Alarm mode	<p>Restricted operation launched by RTC alert function while the module is in Power Down mode. Module will not be registered to GSM network. Limited number of AT commands is accessible.</p>	

## 4 Antenna Interface

The RF interface has an impedance of  $50\Omega$ . AGS2-W is capable of sustaining a total mismatch at the antenna lines without any damage, even when transmitting at maximum RF power.

The external antenna must be matched properly to achieve best performance regarding radiated power, modulation accuracy and harmonic suppression. Antenna matching networks are not included on the AGS2-W module and should be placed in the host application if the antenna does not have an impedance of  $50\Omega$ .

Regarding the return loss AGS2-W provides the following values in the active band:

**Table 8:** Return loss in the active band

State of module	Return loss of module	Recommended return loss of application
Receive	$\geq 8\text{dB}$	$\geq 12\text{dB}$
Transmit	not applicable	$\geq 12\text{dB}$

## 5 Electrical, Reliability and Radio Characteristics

### 5.1 Absolute Maximum Ratings

The absolute maximum ratings stated in [Table 9](#) are stress ratings under any conditions. Stresses beyond any of these limits will cause permanent damage to AGS2-W.

**Table 9:** Absolute maximum ratings

Parameter	Min	Max	Unit
Supply voltage BATT+	-0.3	+6.0	V
Voltage at all digital lines in Power Down mode	-0.3	+0.3	V
Voltage at digital lines 1.8V domain in normal operation	-0.3	+2.2	V
Voltage at digital lines VDIG domain (1.8V) in normal operation	-0.3	+2.2	V
Voltage at digital lines VDIG domain (2.85V) in normal operation	-0.3	+3.3	V
Voltage at SIM interface, CCVCC 1.8V in normal Operation	-0.3	+2.2	V
Voltage at SIM interface, CCVCC 2.85V in normal Operation	-0.3	+3.3	V
Voltage at analog lines in normal operation	-0.3	+3.0	V
Voltage at analog lines in Power Down mode	-0.3	+0.3	V
VDDL	-0.3	+2.5	V

## 5.2 Operating Temperatures

Please note that the module's lifetime, i.e., the MTTF (mean time to failure) may be reduced, if operated outside the extended temperature range. A special URC reports whether the module enters or leaves the extended temperature range (see [1]; AT^SCTM).

**Table 10:** Board temperature

Parameter	Min	Typ	Max	Unit
Normal operation	-30	+25	+85	°C
Extended operation <sup>1</sup>	-40 to -30		+85 to +90	°C
Automatic shutdown <sup>2</sup> Temperature measured on AGS2-W board	<-40	---	>+90	°C

1. Extended operation allows normal mode speech calls or data transmission for limited time until automatic thermal shutdown takes effect. Within the extended temperature range (outside the normal operating temperature range) the specified electrical characteristics may be in- or decreased.
2. Due to temperature measurement uncertainty, a tolerance of  $\pm 3^{\circ}\text{C}$  on the thresholds may occur.

Note that within the specified operating temperature ranges the board temperature may vary to a great extent depending on operating mode, used frequency band, radio output power and current supply voltage.

When data are transmitted over GPRS the module automatically reverts to a lower Multislot Class if the temperature rises to the limit specified for normal operation and, vice versa, returns to the higher Multislot Class if the temperature is back to normal.

### 5.3 Storage Conditions

AGS2-W modules, as delivered in tape and reel carriers, must be stored in sealed, moisture barrier anti-static bags. The conditions stated below are only valid for modules in their original packed state in weather protected, non-temperature-controlled storage locations. Normal storage time under these conditions is 12 months maximum.

**Table 11:** Storage conditions

Type	Condition	Unit	Reference
Air temperature: Low High	-25 +40	°C	IPC/JEDEC J-STD-033A
Humidity relative: Low High	10 90 at 40°C	%	IPC/JEDEC J-STD-033A
Air pressure: Low High	70 106	kPa	IEC TR 60271-3-1: 1K4 IEC TR 60271-3-1: 1K4
Movement of surrounding air	1.0	m/s	IEC TR 60271-3-1: 1K4
Water: rain, dripping, icing and frosting	Not allowed	---	---
Radiation: Solar Heat	1120 600	W/m <sup>2</sup>	ETS 300 019-2-1: T1.2, IEC 60068-2-2 Bb ETS 300 019-2-1: T1.2, IEC 60068-2-2 Bb
Chemically active substances	Not recommended		IEC TR 60271-3-1: 1C1L
Mechanically active substances	Not recommended		IEC TR 60271-3-1: 1S1
Vibration sinusoidal: Displacement Acceleration Frequency range	1.5 5 2-9 9-200	mm m/s <sup>2</sup> Hz	IEC TR 60271-3-1: 1M2
Shocks: Shock spectrum Duration Acceleration	semi-sinusoidal 1 50	ms m/s <sup>2</sup>	IEC 60068-2-27 Ea

## 5.4 Storage Conditions

AGS2-W modules, as delivered in tape and reel carriers, must be stored in sealed, moisture barrier anti-static bags. The conditions stated below are only valid for modules in their original packed state in weather protected, non-temperature-controlled storage locations. Normal storage time under these conditions is 12 months maximum.

**Table 12:** Storage conditions

Type	Condition	Unit	Reference
Air temperature: Low High	-25 +40	°C	IPC/JEDEC J-STD-033A
Humidity relative: Low High	10 90 at 40°C	%	IPC/JEDEC J-STD-033A
Air pressure: Low High	70 106	kPa	IEC TR 60271-3-1: 1K4 IEC TR 60271-3-1: 1K4
Movement of surrounding air	1.0	m/s	IEC TR 60271-3-1: 1K4
Water: rain, dripping, icing and frosting	Not allowed	---	---
Radiation: Solar Heat	1120 600	W/m <sup>2</sup>	ETS 300 019-2-1: T1.2, IEC 60068-2-2 Bb ETS 300 019-2-1: T1.2, IEC 60068-2-2 Bb
Chemically active substances	Not recommended		IEC TR 60271-3-1: 1C1L
Mechanically active substances	Not recommended		IEC TR 60271-3-1: 1S1
Vibration sinusoidal: Displacement Acceleration Frequency range	1.5 5 2-9 9-200	mm m/s <sup>2</sup> Hz	IEC TR 60271-3-1: 1M2
Shocks: Shock spectrum Duration Acceleration	semi-sinusoidal 1 50	ms m/s <sup>2</sup>	IEC 60068-2-27 Ea



## 5.5 Reliability Characteristics

The test conditions stated below are an extract of the complete test specifications.

**Table 13:** Summary of reliability test conditions

Type of test	Conditions	Standard
Vibration	Frequency range: 10-20Hz; acceleration: 5g Frequency range: 20-500Hz; acceleration: 20g Duration: 20h per axis; 3 axes	DIN IEC 60068-2-6 <sup>1</sup>
Shock half-sinus	Acceleration: 500g Shock duration: 1msec 1 shock per axis 6 positions ( $\pm$ x, y and z)	DIN IEC 60068-2-27
Dry heat	Temperature: +70 $\pm$ 2°C Test duration: 16h Humidity in the test chamber: < 50%	EN 60068-2-2 Bb ETS 300 019-2-7
Temperature change (shock)	Low temperature: -40°C $\pm$ 2°C High temperature: +85°C $\pm$ 2°C Changeover time: < 30s (dual chamber system) Test duration: 1h Number of repetitions: 100	DIN IEC 60068-2-14 Na ETS 300 019-2-7
Damp heat cyclic	High temperature: +55°C $\pm$ 2°C Low temperature: +25°C $\pm$ 2°C Humidity: 93% $\pm$ 3% Number of repetitions: 6 Test duration: 12h + 12h	DIN IEC 60068-2-30 Db ETS 300 019-2-5
Cold (constant exposure)	Temperature: -40 $\pm$ 2°C Test duration: 16h	DIN IEC 60068-2-1

1. For reliability tests in the frequency range 20-500Hz the Standard's acceleration reference value was increased to 20g.

## 5.6 Pad Assignment

The SMT application interface on the AGS2-W provides connecting pads to integrate the module into external applications. Figure 1 shows the connecting pads' numbering plan, the following Table 14 lists the pads' assignments.

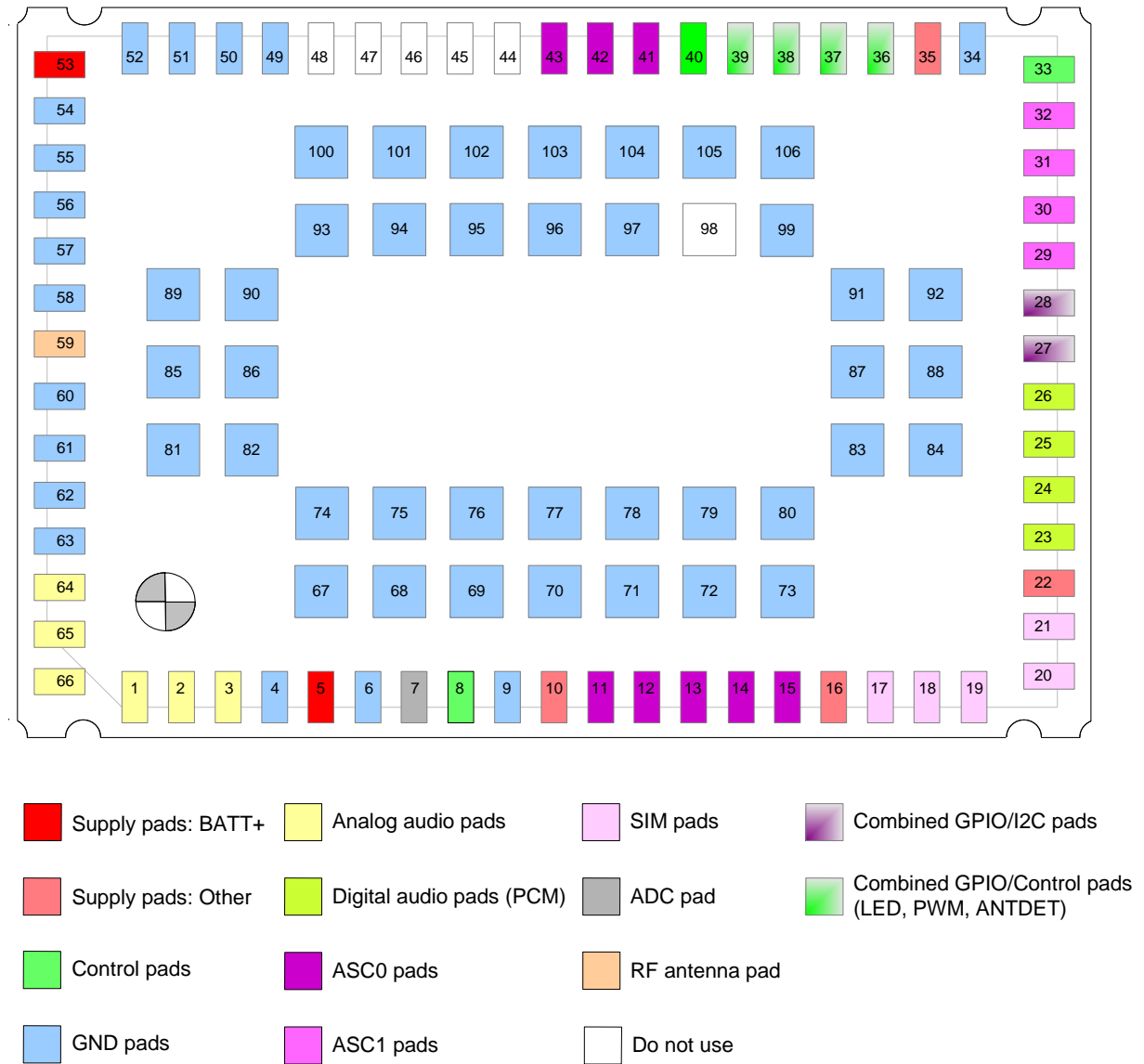


Figure 1: Numbering plan for connecting pads (bottom view)

**Table 14:** Pad assignments

Pad no.	Signal name	Pad no.	Signal name	Pad no.	Signal name
1	VMIC	23	TXDDAI	45	Do not use
2	EPN	24	TFSDAI	46	Do not use
3	EPP	25	RXDDAI	47	Do not use
4	GND	26	SCLK	48	Do not use
5	BATT+	27	GPIO10/I2CDAT	49	GND
6	GND	28	GPIO9/I2CCLK	50	GND
7	ADC1	29	TXD1	51	GND
8	ON	30	RXD1	52	GND
9	GND	31	RTS1	53	BATT+
10	VDIG	32	CTS1	54	GND
11	RXD0	33	EMERG_RST	55	GND
12	CTS0	34	GND	56	GND
13	TXD0	35	V180	57	GND
14	RING0	36	GPIO8/ ANTDET_ON	58	GND
15	RTS0	37	GPIO7/PWM1/ ANTDET_SEL	59	RF_OUT
16	VDDL	38	GPIO6/PWM2/ ANT_ACT	60	GND
17	CCRST	39	GPIO5/LED	61	GND
18	CCIN	40	FAST_SHTDWN	62	GND
19	CCIO	41	DSR0	63	GND
20	CCVCC	42	DCD0	64	AGND
21	CCCLK	43	DTR0	65	MICP
22	V285	44	Do not use	66	MICN
				67-106	GND <sup>1</sup>

1. The pads 67-106 are centrally located and should be connected to Ground **except** for pad 98 that is only required for factory tests. Pad 98 must not be connected to the external application, but should be left open.

Signal pads that are not used should not be connected to an external application.

## 5.7 Power Supply Ratings

Table 15: Power supply ratings

Parameter	Description	Conditions	Min	Typ	Max	Unit
BATT+	Supply voltage	Voltage must stay within the min/max values, including voltage drop, ripple and spikes.	3.3	4.0	4.5	V
	Voltage drop during transmit burst	Normal condition, power control level for P <sub>out max</sub>			400	mV
	Voltage ripple	Normal condition, power control level for P <sub>out max</sub> @ f ≤ 250kHz @ f > 250kHz			85 25	mVpp
I <sub>VDDL</sub>	OFF state supply current	RTC backup @ BATT+ = 0V @ VDDL = 2.3V		8.0		µA
		Power Down mode		45		µA
I <sub>BATT+</sub>	Average supply current	SLEEP mode, GSM <sup>1</sup> @ DRX = 2 @ DRX = 5 @ DRX = 9		2.1 1.5 1.1		mA
		SLEEP mode, GPRS <sup>2</sup> @ DRX = 2 @ DRX = 5 @ DRX = 9		2.2 1.5 1.2		mA
		IDLE mode <sup>1</sup>		8.6		mA
		TALK mode GSM GSM850/EGSM 900 <sup>2</sup> GSM 1800/1900 <sup>3</sup>		200 150		mA
		DATA mode GPRS 1 TX, 4 Rx GSM 850/EGSM 900 <sup>2</sup> GSM 1800/1900 <sup>3</sup>		180 145		mA
		DATA mode GPRS 2 Tx, 3 Rx GSM 850/EGSM 900 <sup>2</sup> GSM 1800/1900 <sup>3</sup>		330 260		mA
	Peak supply current (during transmission slot every 4.6ms)	Power Control Level GSM 850/EGSM 900 <sup>2</sup> GSM 1800/1900 <sup>3</sup>		1.30 0.95	1.35 0.97	A

1. Measurements start 3 minutes after the module was switched ON, Averaging times: SLEEP mode - 3 minutes; IDLE mode - 1.5 minutes, Communication tester settings: no neighbour cells, no cell reselection etc.
2. Power control level PCL 5
3. Power control level PCL 0

## 6 Mechanics

### 6.1 Mechanical Dimensions of AGS2-W

Figure 2 shows the top and bottom view of AGS2-W and provides an overview of the board's mechanical dimensions.

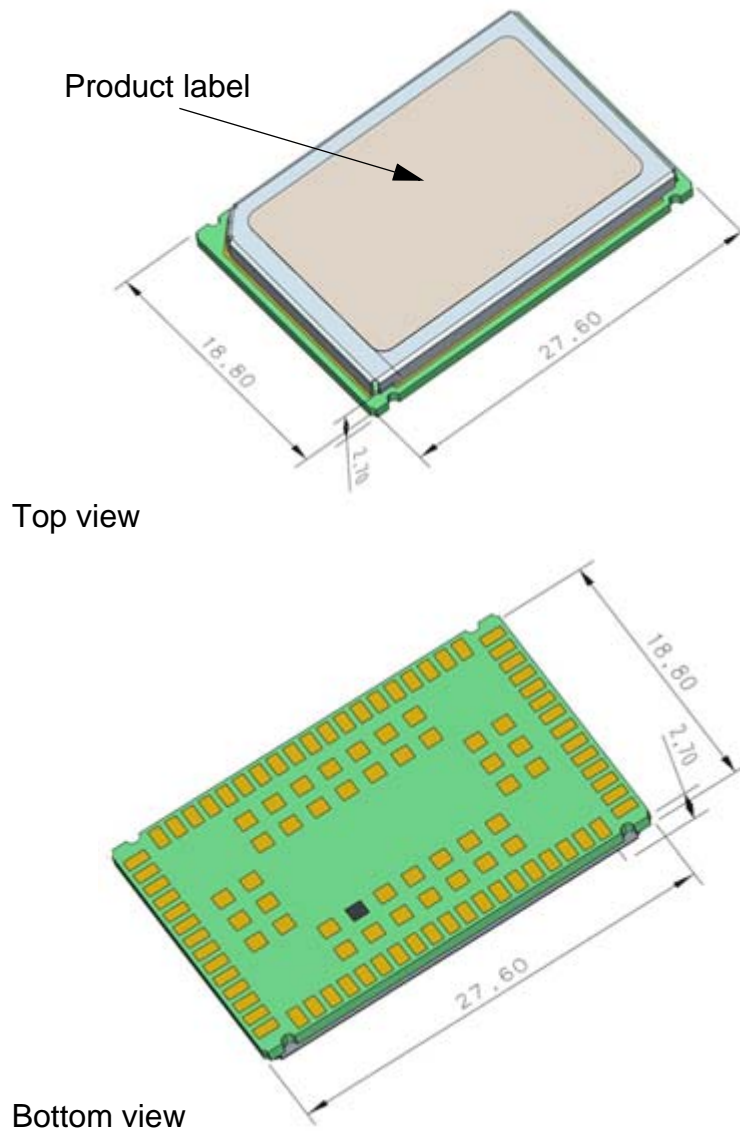


Figure 2: AGS2-W– top and bottom view

## 7 Reference Approval

### 7.1 Reference Equipment for Type Approval

The Cinterion Wireless Modules reference setup submitted to type approve AGS2-W is shown in the following figure:

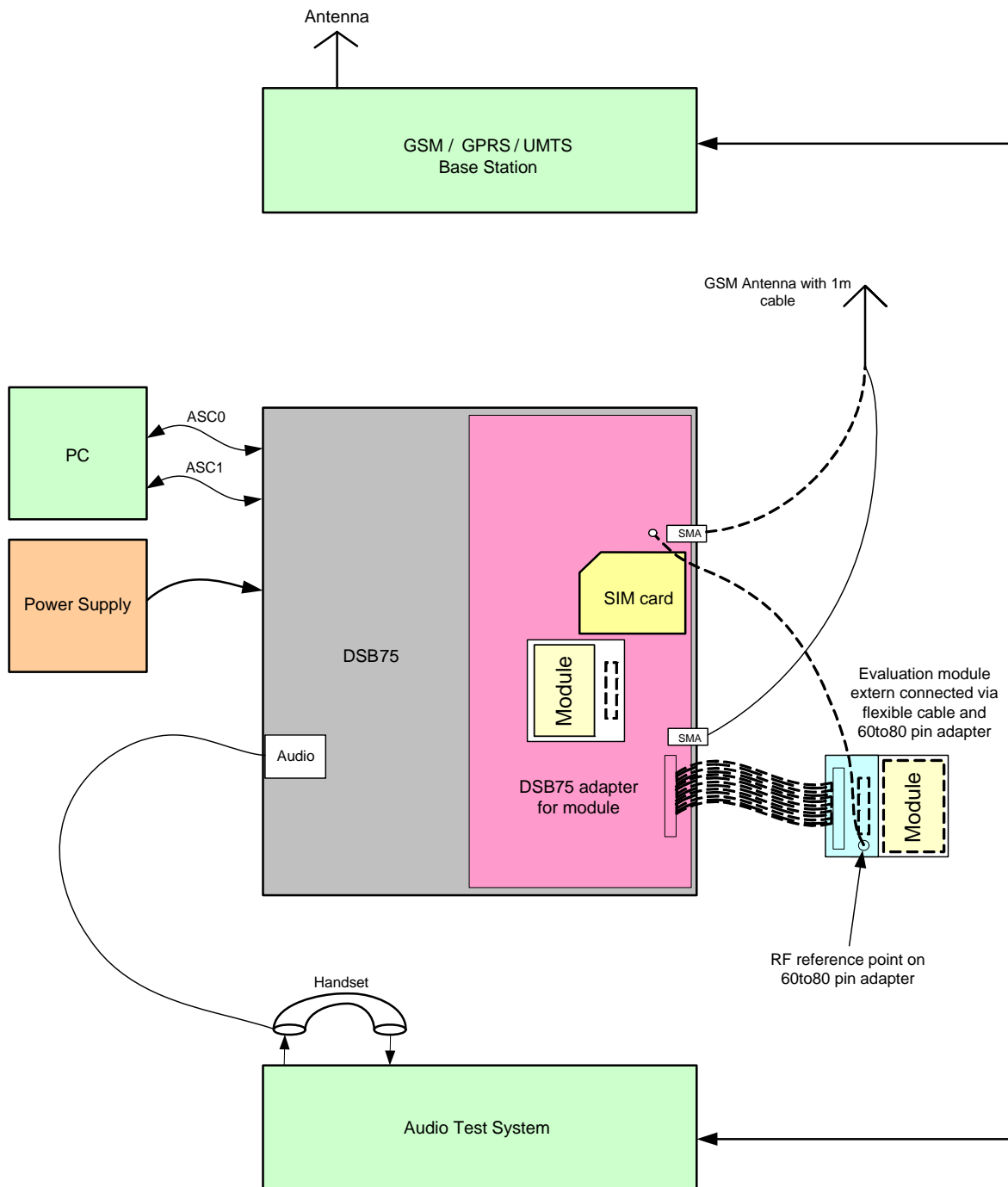


Figure 3: Reference equipment for Type Approval

## 7.2 Compliance with FCC and IC Rules and Regulations

The Equipment Authorization Certification for the Cinterion Wireless Modules reference application described in [Section 7.1](#) will be registered under the following identifiers:

*FCC Identifier: QIPAGS2*

*Industry Canada Certification Number: 7830A-AGS2*

*Granted to Cinterion Wireless Modules GmbH*

Manufacturers of mobile or fixed devices incorporating AGS2-W modules are authorized to use the FCC Grants and Industry Canada Certificates of the AGS2-W modules for their own final products according to the conditions referenced in these documents. In this case, an FCC/ IC label of the module shall be visible from the outside, or the host device shall bear a second label stating "Contains FCC ID QIPAGS2", and accordingly "Contains IC 7830A-AGS2".

The integration is limited to fixed or mobile categorised host devices, where a separation distance between the antenna and any person of min. 20cm can be assured during normal operating conditions. For mobile and fixed operation configurations the antenna gain, including cable loss, must not exceed the limits 7.24 dBi (850 MHz) and 3.30 dBi (1900 MHz). See [\[3\]](#).

#### IMPORTANT:

Manufacturers of portable applications incorporating AGS2-W modules are required to have their final product certified and apply for their own FCC Grant and Industry Canada Certificate related to the specific portable mobile. This is mandatory to meet the SAR requirements for portable mobiles (see [Section 1.3.2](#) for detail).

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

#### Note:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

The manufacturer is responsible for ensuring that after the module is installed and operational the host continues to be compliant with the Part 15B unintentional radiator requirements.

## 8 Appendix

### 8.1 List of Parts and Accessories

**Table 16:** List of parts and accessories

Description	Supplier	Ordering information
AGS2-W	Cinterion	Standard module Ordering number: TBD.
DSB75 Evaluation Kit	Cinterion	Ordering number: L36880-N8811-A100
Adapter for mounting the AGS2-W evaluation module onto the DSB75	Cinterion	Ordering number: TBD.
Evaluation Module	Cinterion	Ordering number: TBD.
Votronic Handset	VOTRONIC	Votronic HH-SI-30.3/V1.1/0 VOTRONIC Entwicklungs- und Produktionsgesellschaft für elektronische Geräte mbH Saarbrücker Str. 8 66386 St. Ingbert Germany Phone: +49-(0)6 89 4 / 92 55-0 Fax: +49-(0)6 89 4 / 92 55-88 Email: <a href="mailto:contact@votronic.com">contact@votronic.com</a>
SIM card holder incl. push button ejector and slide-in tray	Molex	Ordering numbers: 91228 91236 Sales contacts are listed in <a href="#">Table 17</a> .



**Table 17:** Molex sales contacts (subject to change)

<p>Molex For further information please click: <a href="http://www.molex.com">http://www.molex.com</a></p>	<p>Molex Deutschland GmbH Otto-Hahn-Str. 1b 69190 Walldorf Germany Phone: +49-6227-3091-0 Fax: +49-6227-3091-8100 Email: <a href="mailto:mxgermany@molex.com">mxgermany@molex.com</a></p>	<p>American Headquarters Lisle, Illinois 60532 U.S.A. Phone: +1-800-78MOLEX Fax: +1-630-969-1352</p>
<p>Molex China Distributors Beijing, Room 1311, Tower B, COFCO Plaza No. 8, Jian Guo Men Nei Street, 100005 Beijing P.R. China Phone: +86-10-6526-9628 Fax: +86-10-6526-9730</p>	<p>Molex Singapore Pte. Ltd. 110, International Road Jurong Town, Singapore 629174  Phone: +65-6-268-6868 Fax: +65-6-265-6044</p>	<p>Molex Japan Co. Ltd. 1-5-4 Fukami-Higashi, Yamato-City, Kanagawa, 242-8585 Japan  Phone: +81-46-265-2325 Fax: +81-46-265-2365</p>